Routing Protocols For Wireless Ad Hoc Networks

On-Demand Routing Protocols

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Outline:

1 – Requirements of routing protocols for wireless ad hoc networks vs. on-demand routing protocols

2 – On-Demand Routing Protocols : Three main approaches?!

3 – Ad-hoc On-Demand Distance Vector Routing Protocol: AODV

1 - Requirements of routing protocols for wireless ad hoc networks vs. on-demand routing protocols: (1/2)

1 – Fully distributed. ***(√)***

Mainly, on-demand routing protocols do not employ any central schemes.

2 – Adaptive to dynamically changing network topology. ***(√)***

The main theme of on-demand routing protocols:
(Find a route when its only required).

=> ***Very adaptive to topology changes***

3 – Less number of nodes involved in connection setup.

(Not all on demand protocols satisfy this property)

4 – Local State Maintenance. ***(√)***

None global state information are kept by any mean.

1 - Requirements of routing protocols for wireless ad hoc networks vs. on-demand routing protocols: (2/2)

5 – Loop free and stale routes free.

(Not all on demand protocols satisfy this property specially if some sort of route cache is applied).

6 – Converge to optimal routes for the topologically stable networks.

(Not all on demand protocols satisfy this property, it depends on the availability of routes according to some metrics)

7 – Considering the limited resource of the nodes and the transmission medium.

(Not all on demand protocols satisfy this property, it is satisfied by only this portion of on-demand routing protocols which considers the link life time or nodes associativity)

2 – On-Demand Routing Protocols : Three main approaches?! (1/4)

1 – Global route discovery and maintenance approach:

Dynamic Source Routing Protocol (DSR), and Ad-Hoc On-demand Distance-Vector Routing Protocol (AODV).

2 – Local route maintenance [and discovery] approach:

Temporally Ordered Routing Algorithm (TORA), and Location Aided Routing Protocol (LAR).

3 – Link stability based route selection approach:

Associativity Based Routing Protocol (ABR), Signal Stability Based Routing Protocol (SSA), and Flow Oriented Routing Protocol (FORP).

2 – On-Demand Routing Protocols : Three main approaches?! (2/4)

1 – Global route discovery and maintenance approach:

- A source node needs a route to a destination node:

=> *it floods a route request packet*

- A node which has a route to the destination/ the destination:

=> *it responds by a route reply packet*

(Route discovery is global)

- In case of a broken link:

=> *The source node is informed*

=> *It re-invokes the route discovery mechanism*

(Route maintenance is also global)

Example protocols: DSR and AODV.

2 – On-Demand Routing Protocols : Three main approaches?! (3/4)

2 – Local route maintenance [and discovery] approach:

- A source node needs a route to a destination node:

=> it floods a query packet (TORA)

Or => it floods a route request packet only inside an geographic zone where it expects the destination (LAR)

- An intermediate node/the destination:

=> it responds by an update packet to establish directed non- cyclic paths to the destination. (TORA)

Or => it replies by a route reply packet within the same expected zone (LAR)

(Route discovery is global in TORA and local in LAR)

- In case of a broken link:

=> (TORA) has its own local mechanism

=> (LAR) may informs the source to re-establish a route but still within an expected zone

(Route maintenance is local for both)

2 – On-Demand Routing Protocols : Three main approaches?! (4/4)

3 – Link stability based route selection and maintenance approach:

- The traditional flooding of route request and the route reply packets are used for route discovery, however:

"The selected route should contain as much stable links as possible"

- A stable link:

- the one with more beacon counts (ABR).

- the one with stronger beacon signals (SSA).

-the one which has larger predicted expiry time (FORP).

- In case of a broken link:

The same measures are applied for the route maintance.

3 – Ad Hoc On Demand Distance Vector Routing protocol: AODV

1 – Key features:

- On-demand route establishment.

- Each intermediate node maintains a next hop entry along a currently established path.

- It uses periodic hello messages to detect link failures.

- Routing control packets:

1 – A Route discovery packet contains:

{source address, source sequence#, broadcast ID, destination address, destination sequence#, hop count}

2 - A Route reply packet contains:

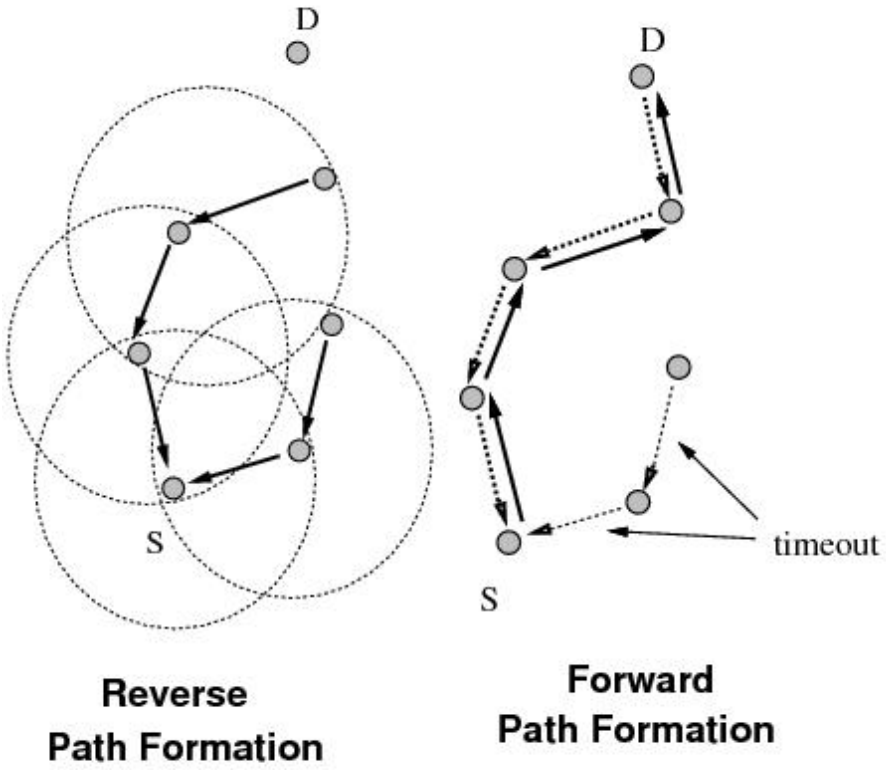
{source address, destination address, destination sequence#, hop count, life time}

3 – Ad Hoc On Demand Distance Vector Routing protocol: AODV

2 – Path discovery:

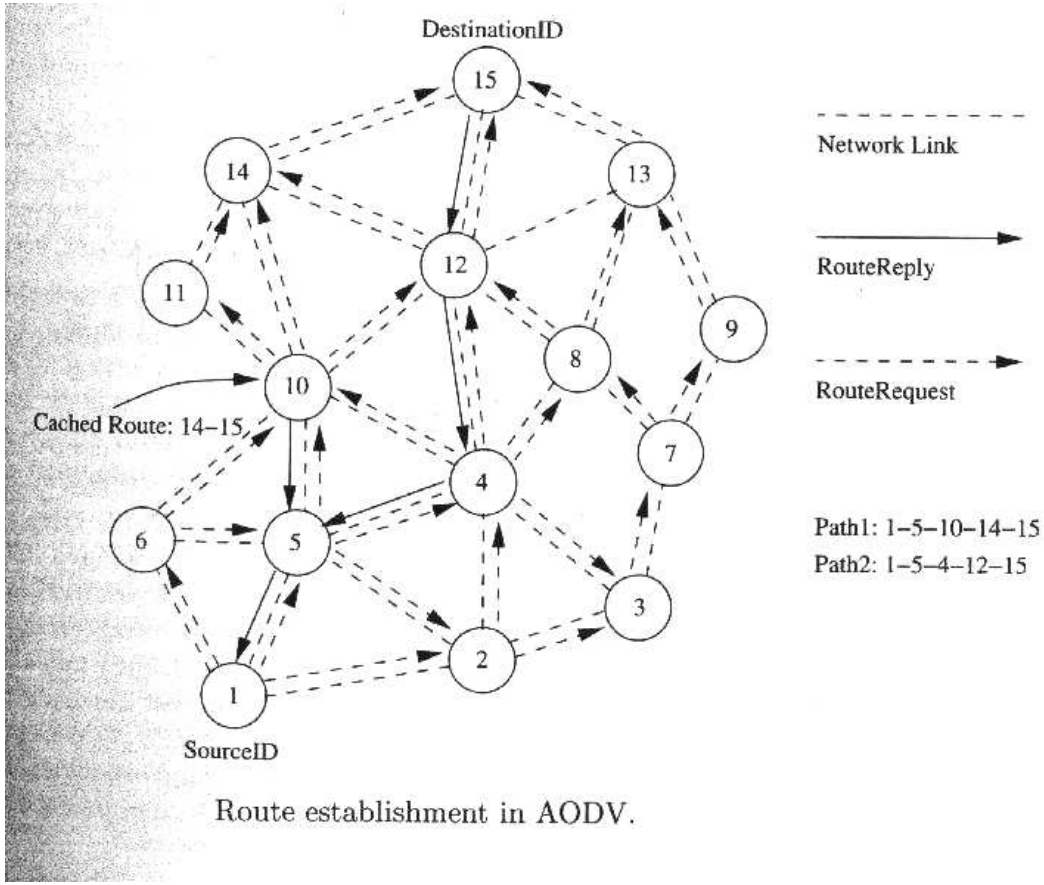
a - Reverse path setup.

b – Forward path setup.



3 – Ad Hoc On Demand Distance Vector Routing protocol: AODV

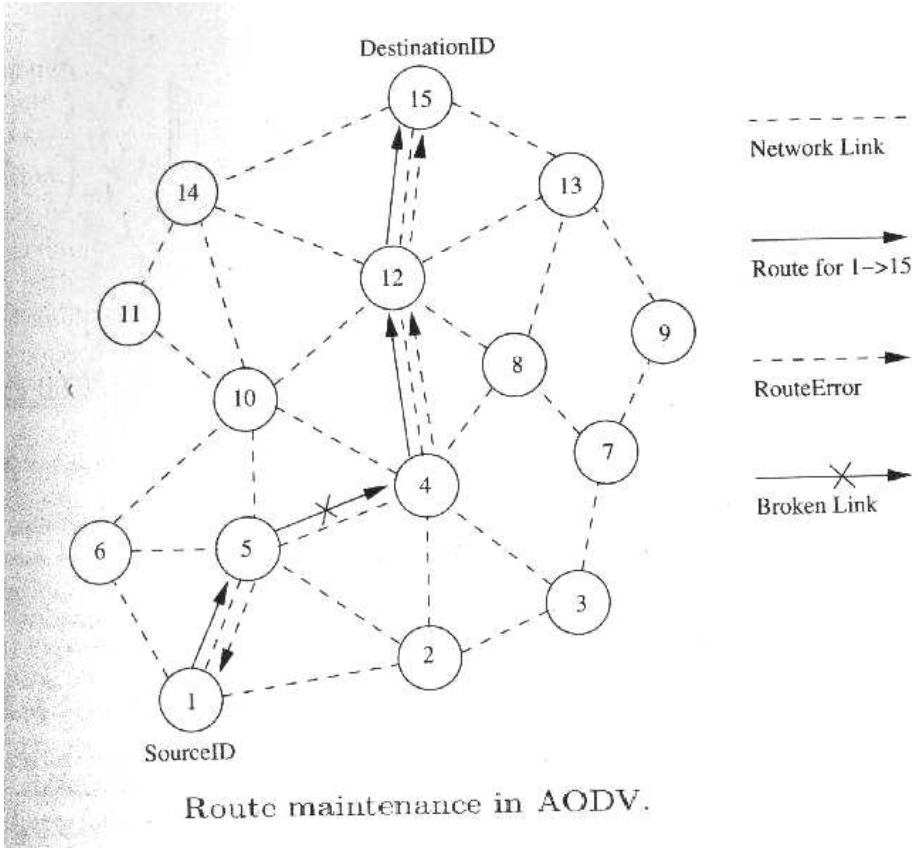
3 – A route establishment example:



Route establishment in AODV.

3 – Ad Hoc On Demand Distance Vector Routing protocol: AODV

4 – A route maintenance example:



Route maintenance in AODV.

Summery:

1 – Generally, On-demand routing protocols satisfy most of the requirements for wireless ad hoc networks

2 – On-Demand Routing Protocols can be clustered in groups. ***Can this leads to better aggregate proposals?***

3 – AODV is a typical example of On-demand routing protocols.